

How to: Contact Angle

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141124

Sample/Fluid Preparation

- Prepare surface
 - Mechanically and chemically polish
 - Electrochemically roughen
 - Put in SAM at least 24 hrs before (optional)
- Prepare Fluid
 - If using fluid which isn't of water, make sure to have FRESH fluid in sealed vial
 - Any water in solvents may affect contact angle

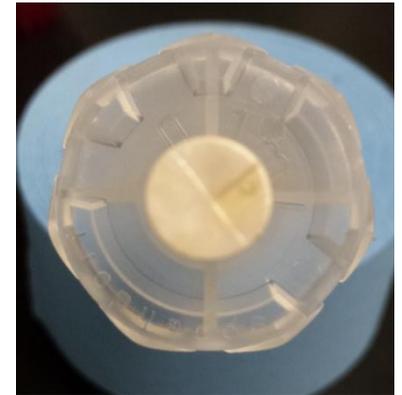
Instrument Preparation

- Turn on light
 - Found that having the light a little dimmer allows for easier readings later
- Take cap off camera
- Turn on automated fluid dispenser
 - 20 μ L at the slowest speed



Fluid Preparation

- Load tip into fluid dispenser
 - Want the 3 spaces facing the back side of the dispenser
 - Push up until it clicks in
- Press **red** reset button
- Load fluid
 - Hold vial up so the tip is dipped into fluid
 - Press **green** up arrow



Tip and Sample Adjustments

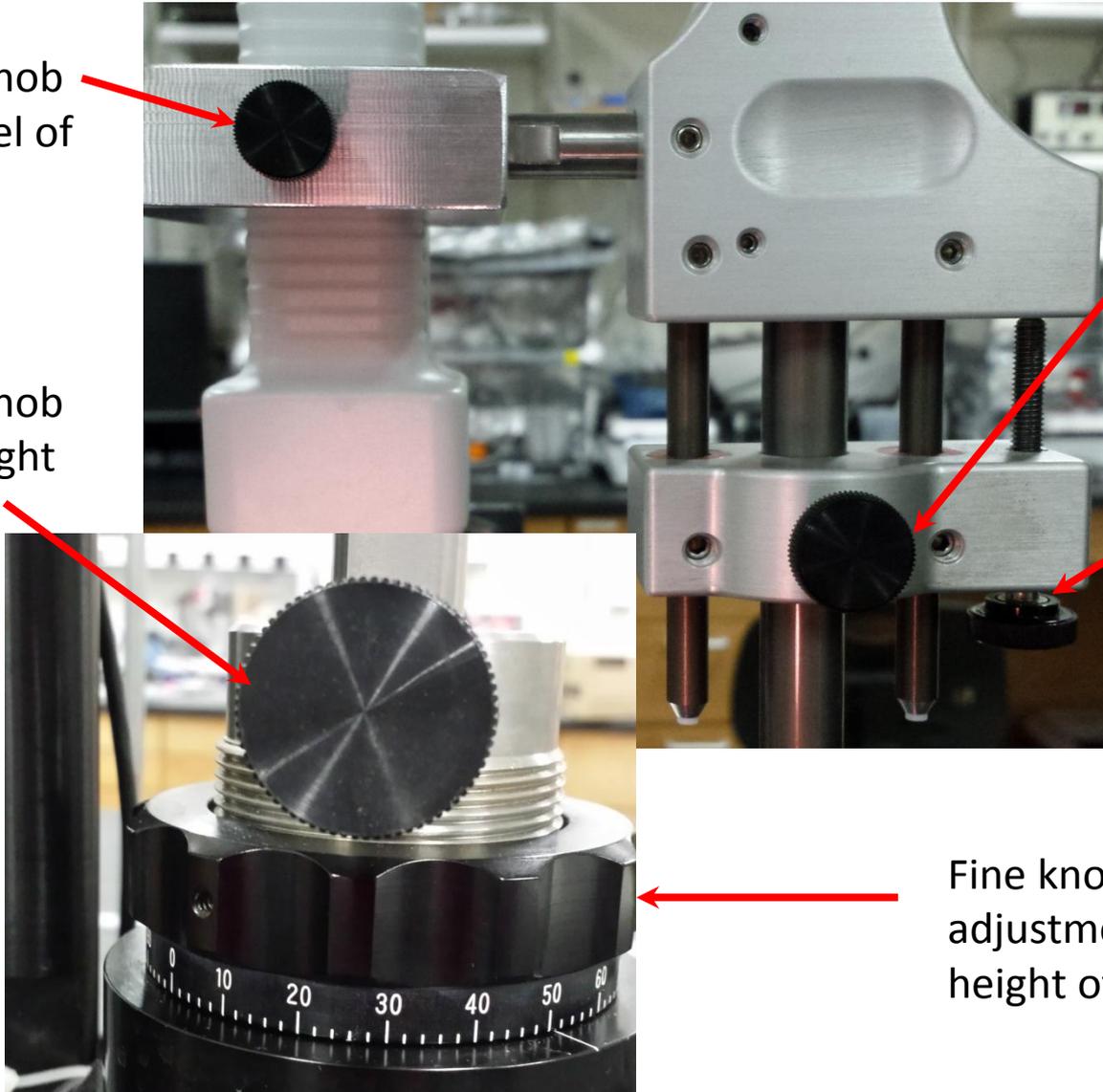
Tightening knob to adjust level of dispenser

Tightening knob to adjust height of sample

Tightening knob to adjust height of tip

Fine knob adjustment for height of tip

Fine knob adjustment for height of sample



Software Preparation

- On the desktop, Click camera icon
 - Choose monochromatic option
- Once opened press Play button in top left
- May want to decrease ratio to 1:2 so entire picture can be seen



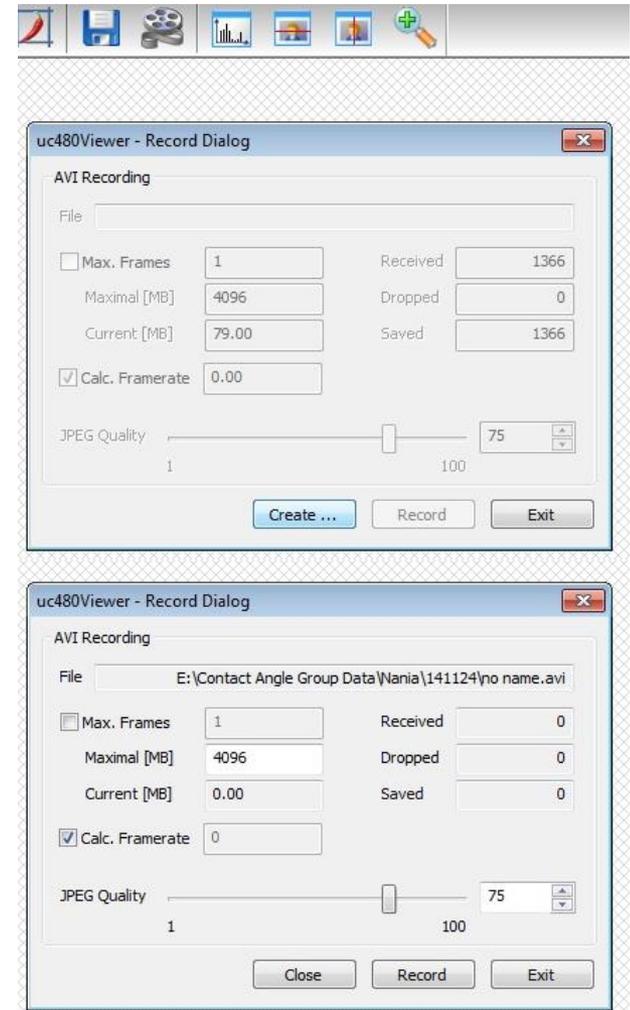
Focus Adjustments

- Make sure the two lens adjustments are turned all the way to the left to ensure farthest sample
 - This allows the whole sample to be in the shot
- Adjust any other focus using the rolling knob

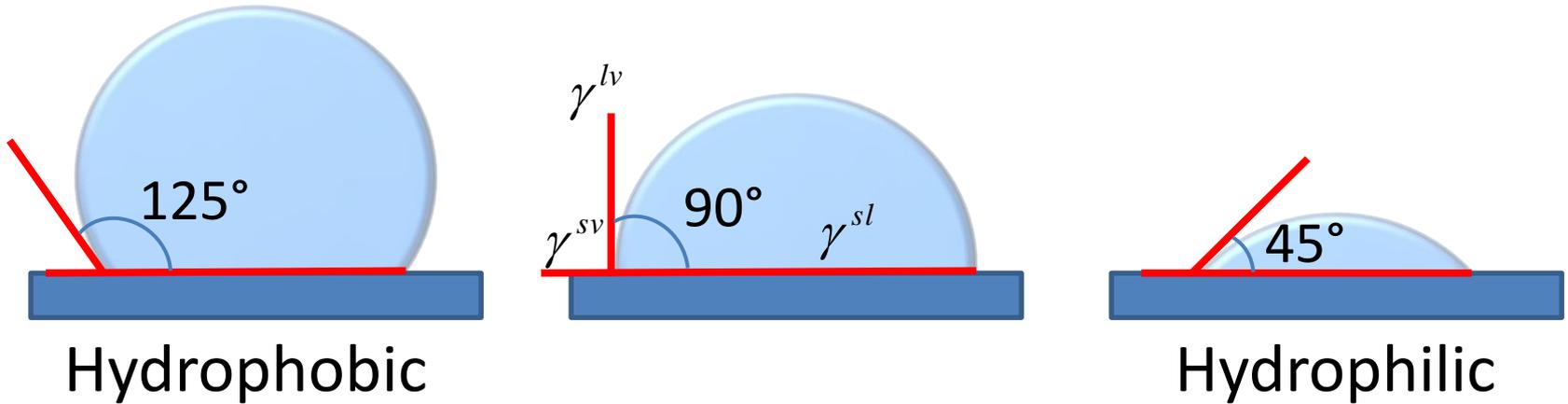


Taking Contact Angle Video

- Press reel in the top bar
- Box (left) will pop up
 - Need to create file before recording
- Box (right) allows you to record and stop
- Dispense liquid using **orange** down arrow on dispenser
- Press stop and then close to end the video
- Need to then PrtSc separate images
 - Save as JPEG



Background Contact Angle Analysis



$$\gamma^{sv} = \gamma^{sl} + \gamma^{lv} \cos \theta$$

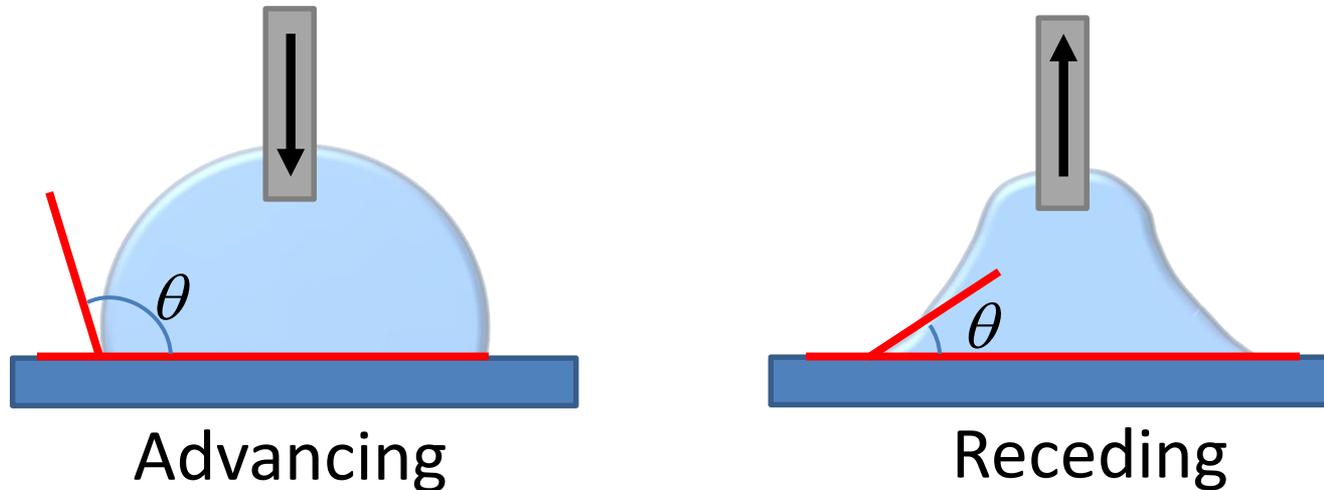
θ : Contact Angle

γ^{sl} : Solid/liquid interfacial free energy

γ^{sv} : Solid surface free energy

γ^{lv} : Liquid surface free energy

Background Contact Angle Analysis



$$\theta_{Hysteresis} = \theta_{Advancing} - \theta_{Receding}$$

- Need to be careful because the capillary dispenser may cause deformation of the geometry

Contact Angle Analysis: ImageJ



141124 How to Contact Angle.pptx - PowerPoint

ImageJ

File Edit Image Process Analyze Plugins Window Help

x=1002, y=727, angle=47.06

Ag1 Rough Hexanethiol chlorobenzene drop 1S.jpg (75%)

1680x1050 pixels; RGB; 6.7MB

Angling Button

Angle readout

Set line for solid/liquid interface and line tangent to vapor/solid interface

Contact Angle Analysis

- Need to get images of advancing, static, and receding contact angles
- Need to measure both left and right of each image
 - This allows for more data points



Advancing



Static



Receding

Contact Angle Analysis

- Once all data is collected
 - Combined left and right measures with each different droplet

$$Avg: \frac{a_1 + a_2 + \dots + a_n}{n} \quad StDev: \sqrt{\frac{(a_1 - a)^2 + (a_2 - a)^2 + \dots + (a_n - a)^2}{n}}$$

$$Pooled \ StDev: \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2 + \dots + (n_k - 1)s_k^2}{n_1 + n_2 + \dots + n_k - k}}$$

	Ag3		Ag4	
	Average	Ag3 StDev	Average	Ag4 StDev
Advancing	43.48	1.427703	51.57	0.356955
Receding	23.85333	1.709616	35.01667	1.071871
Static	42.78167	1.127642	50.80667	0.223308

<i>Ag-Hexanethiol</i>	Smooth Chlorobenzene			Smooth o-Dichlorobenzene		
	Advancin			Advancin		
	g	Receding	Static	g	Receding	Static
Pooled Average	43.48	23.85	42.78	51.57	35.02	50.81
Pooled StDev	1.43	1.71	1.13	0.36	1.07	0.22